Chapter 1

1) The number 0.00430 has _____ significant figures, while the number 1.00430 has _____ significant figures.

D

Leading zeros are nonsignificant

A) 5, 4
B) 6, 5
C) 4, 3
D) 3, 6
E) 2, 5

2) The correct answer (reported to the proper number of significant figures) to the following operation: (6.2 × 3.25) is _____.

A) 20.

B) 20.1

C) 20.15

D) 20.2

E) 21

3) The density of a metal cube with a volume 1.68 cm^3, and mass 32.4 g is _____.

B

3 significant figures.

Unit: g/cm^3

A) 0.0519 g/cm^3

B) 19.3 g/cm^3

C) 54.4 cm^3/g

D) 19.3 g/cm

E) 32.4 g.cm^3

Chapter 2

1) A certain mass of carbon reacts with 13.6 g of oxygen to form carbon monoxide. _____ grams of oxygen would react with that same mass of carbon to form carbon dioxide, according to the law of multiple proportions?

E

Double the mass in CO

 A) 25.6   B) 6.8   C) 13.6

D) 136   E) 27.2

2) Which statement below correctly describes the responses of alpha, beta, and gamma radiation to an electric field?

A) Both beta and gamma are deflected in the same direction, while alpha shows no response.

B) Both alpha and gamma are deflected in the same direction, while beta shows no response.

C) Both alpha and beta are deflected in the same direction, while gamma shows no response.

D) Alpha and beta are deflected in opposite directions, while gamma shows no response.

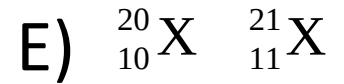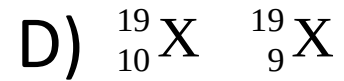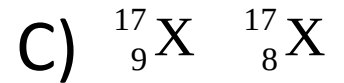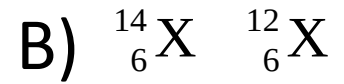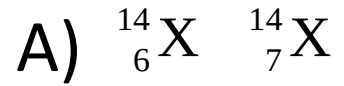E) Only alpha is deflected, while beta and gamma show no response.

D

Alpha particles are positively charged

Beta particles are negatively charged

Gamma rays carry no charge

3) Which pair of atoms constitutes a pair of isotopes of the same element?

A) $_{6}^{14}X$ $_{7}^{14}X$

B) $_{6}^{14}X$ $_{6}^{12}X$

C) $_{9}^{17}X$ $_{8}^{17}X$

D) $_{10}^{19}X$ $_{9}^{19}X$

E) $_{10}^{20}X$ $_{11}^{21}X$

B

Same atomic number but different mass number

4) The element _____ is the most similar to strontium (Sr) in chemical and physical properties.

D

Same group

A) Li   B) At   C) Rb

D) Ba   E) Cs

5) Elements in Group 6A are known as the _____.

A) alkali metals

B) chalcogens

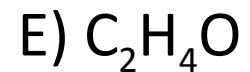C) alkaline earth metals

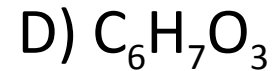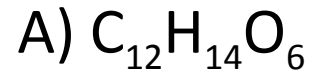D) halogens

E) noble gases

B

1A: Alkali metals

2A: Alkaline earth metals

7A: Halogens

8A: Noble gases

6) The empirical formula of a compound with molecules containing 12 carbon atoms, 14 hydrogen atoms, and 6 oxygen atoms is _____.

A) $C_{12}H_{14}O_6$

B) CHO

C) CH_2O

D) $C_6H_7O_3$

E) C_2H_4O

D

Molecular formula: $C_{12}H_{14}O_6$

Divide by 2:

Empirical formula: $C_6H_7O_3$

7) A molecule of water contains hydrogen and oxygen in a 1:8 ratio by mass. This is a statement of _____.

B

A) the law of multiple proportions

B) the law of constant composition

C) the law of conservation of mass

D) the law of conservation of energy

E) none of the above

8) Which one of the following is **not** one of the postulates of Dalton's atomic theory?

A

A) Atoms are composed of protons, neutrons, and electrons.

B) All atoms of a given element are identical; the atoms of different elements are different and have different properties.

C) Atoms of an element are not changed into different types of atoms by chemical reactions: atoms are neither created nor destroyed in chemical reactions.

D) Compounds are formed when atoms of more than one element combine; a given compound always has the same relative number and kind of atoms.

E) Each element is composed of extremely small particles called atoms.

9) Which one of the following is not true concerning cathode rays?

A) They originate from the negative electrode.

B) They travel in straight lines in the absence of electric or magnetic fields.

C) They impart a negative charge to metals exposed to them.

D) They are made up of electrons.

E) The characteristics of cathode rays depend on the material from which they are emitted.

E

The experiment was repeated with different cathode metals.

10) The charge on an electron was determined in the _____.

C

A) cathode ray tube, by J. J. Thompson

B) Rutherford gold foil experiment

C) Millikan oil drop experiment

D) Dalton atomic theory

E) atomic theory of matter

11) In the Rutherford nuclear-atom model, _____.

A) the heavy subatomic particles, protons and neutrons, reside in the nucleus

B) the three principal subatomic particles (protons, neutrons, and electrons) all have essentially the same mass

C) the light subatomic particles, protons and neutrons, reside in the nucleus

D) mass is spread essentially uniformly throughout the atom

E) the three principal subatomic particles (protons, neutrons, and electrons) all have essentially the same mass <u>and</u> mass is spread essentially uniformly throughout the atom

A

Rutherford proposed that the atom's mass resides in the nucleus.

Neutrons were later discovered by Chadwick

12) In the absence of magnetic or electric fields, cathode rays _____.

A) do not exist

B) travel in straight lines

C) cannot be detected

D) become positively charged

E) bend toward a light source

B

Cathode rays are negatively charged, so their path is affected by the magnetic field

13) All atoms of a given element have the same _____.

A) mass

B) number of protons
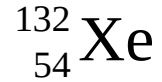
C) number of neutrons

D) number of electrons and neutrons

E) density

B
Atomic number

14) There are _____ electrons, _____ protons, and _____ neutrons in an atom of $^{132}_{54}\text{Xe}$

A) 132, 132, 54

B) 54, 54, 132

C) 78, 78, 54

D) 54, 54, 78

E) 78, 78, 132

D

Atomic number(protons or electrons in a neutral atom): 54

Mass number (protons + neutrons): 132

15) In the symbol below, x = _____.

$$_{6}^{x}C$$

A) 19

B) 13

C) 6

D) 7

E) not enough information to determine

E

Mass number varies with isotopes

16) An unknown element is found to have three naturally occurring isotopes with atomic masses of:

35.9675 (0.337%)

37.9627 (0.063%)

39.9624 (99.600%)

Which of the following is the unknown element?

A) Ar

B) K

C) Cl

D) Ca

E) None of the above could be the unknown element.

A

Average atomic mass is closest to 39.9624 of 99.6% abundance.

Ar: 39.948 (a little less than 39.9624)

17) Which compounds do not have the same empirical formula?

A) C_2H_2 and C_6H_6

B) CO and CO_2

C) C_2H_4 and C_3H_6

D) $C_2H_4O_2$ and $C_6H_{12}O_6$

E) $C_2H_5COOCH_3$ and CH_3CHO

B

Both are lowest ratio

A) CH

C) CH_2

D) CH_2O

E) C_2H_4O

Chapter 6

1) A spectrum containing only specific wavelengths is called a _____ spectrum.

A

A) line

B) continuous

C) visible

D) Rydberg

E) invariant

2) At what speed (m/s) must a 10.0 mg object be moving to have a de Broglie wavelength of 3.3×10^{-41} m?

$h = 6.626 \times 10^{-34}$ J-s

C

Mass = 10.0×10^{-6} Kg

A) 41

B) 1.9×10^{-11}

C) 2.0×10^{12}

D) 3.3×10^{-42}

E) 9.1×10^{31}

$$\lambda = \frac{h}{mv}$$

3) The _____ quantum number defines the shape of an orbital.

A) Spin (m_s)

B) Principal (n)

C) Magnetic (m_l)

D) Angular momentum (l)

E) Phi (Ψ)

D

A) Electron spin

B) Shell energy

C) Orbital orientation

D) Subshell type, i.e., shape of orbitals

E) Ψ^2: probability of finding the electron in the atom's space

4) There are _____ orbitals in the third shell.

A) 25

B) 4

C) 9

D) 16

E) 1

C

Number of orbitals = n^2

Number of electrons = $2n^2$

5) The n = 1 shell contains _____ p orbitals. All the other shells contain _____ p orbitals.

A) 3, 6

B) 0, 3

C) 6, 2

D) 3, 3

E) 0, 6

B

n = 1 has s subshell only

Any p subshell has 3 orbitals

6) In a hydrogen atom, an electron in a _____ orbital can absorb a photon, but cannot emit a photon.

D

n = 1 lowest possible energy level

A) 3s

B) 2s

C) 3p

D) 1s

E) 3f

7) How many p-orbitals are occupied in a Ne atom?

A) 5

B) 6

C) 1

D) 3

E) 2

D

All 3 orbitals of p subshell are occupied

8) How many quantum numbers are necessary to designate a particular electron in an atom?

B

n, l, m_l, m_s

A) 3

B) 4

C) 2

D) 1

E) 5

9) A _____ orbital is degenerate with a 5d$_z^2$ in a many-electron atom.

D

Degenerate orbitals must have the same n and l values

A) 5p$_z$

B) 4d$_z^2$

C) 5$_s$

D) 5d$_{xy}$

E) 4d$_{zz}$

10) The principal quantum number for the outermost electrons in a Br atom in the ground state is _____.

A) 2

B) 3

C) 4

D) 5

E) 1

C

Same as the period number

11) The quantum number (l) for the outermost electrons in a nitrogen atom in the ground state is _____.

A) 0

B) 1

C) 2

D) 3

E) -1

B

The outermost shell has n = 2, same as the period number.

Highest value for l is 1

12) Which group in the periodic table contains elements with the valence electron configuration of ns^2np^1?

C

3 valence electrons

A) 1A

B) 2A

C) 3A

D) 4A

E) 8A

13) Which quantum numbers must be the same for the orbitals that they designate to be degenerate in a many-electron system?

E

Principal shell and subshell

A) n, l, and m/

B) n only

C) n, l, m/, and ms

D) l only

E) n and l only

14) In a p_x orbital, the subscript x denotes the _____ of the electron.
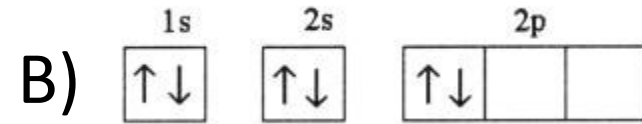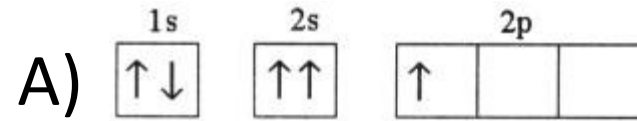
E

A) energy

B) spin of the electrons

C) probability of the shell

D) size of the orbital

E) axis along which the orbital is aligned

15) Which diagram violates Hund's rule?

A)

1s	2s	2p		
↑↓	↑↑	↑		

B)

1s	2s	2p		
↑↓	↑↓	↑↓		

B

A) Pauli

B) Lowest energy is achieved when parallel spin is maximized

16) Which one of the following configurations depicts an excited oxygen atom?

A) $1s^2 2s^2 2p^2$

B) $1s^2 2s^2 2p^2 3s^2$

C) $1s^2 2s^2 2p^1$

D) $1s^2 2s^2 2p^4$

E) $[He]2s^2 2p^4$

B

One electron is promoted to a higher n

Chapter 7

1) An electron in a _____ subshell experiences the greatest effective nuclear charge in a many-electron atom.

A) 3f

B) 3p

C) 3d

D) 3s

E) 4s

D

The most attracted by the protons is the closest to the nucleus, with the lowest "n" value and the lowest energy subshell

2) A tin atom has 50 electrons. Electrons in the _____ subshell experience the (greatest shielding) lowest effective nuclear charge.

A) 1s

B) 3p

C) 3d

D) 5s

E) 5p

E

The least attracted by the protons is the farthest from the nucleus, with the highest "n" value and the highest energy subshell

3) Of the following, which gives the correct order for atomic radius for Mg, Na, P, Si and Ar?

A) Mg > Na > P > Si > Ar

B) Ar > Si > P > Na > Mg

C) Si > P > Ar > Na > Mg

D) Na > Mg > Si > P > Ar

E) Ar > P > Si > Mg > Na

D

Decreases across a period from left to right in the periodic table, all elements lie within the same period

4) _____ is isoelectronic with argon and _____ is isoelectronic with neon.

A) Cl⁻, F⁻

B) Cl⁻, Cl⁺

C) F⁺, F⁻

D) Ne⁻, Kr⁺

E) Ne⁺, Kr⁻

A

Isoelectronic means having the same number of electrons

5) Which isoelectronic series is correctly arranged in order of increasing radius?

A) $K^+ < Ca^{2+} < Ar < Cl^-$

B) $Cl^- < Ar < K^+ < Ca^{2+}$

C) $Ca^{2+} < Ar < K^+ < Cl^-$

D) $Ca^{2+} < K^+ < Ar < Cl^-$

E) $Ca^{2+} < K^+ < Cl^- < Ar$
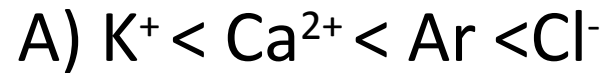
D

All are isoelectronic, the one with the most protons will experience the highest effective nuclear charge, resulting in the smallest radius, and vice versa.

6) Of the choices below, which gives the order for first ionization energies?

A) Cl > S > Al > Ar > Si

B) Ar > Cl > S > Si > Al

C) Al > Si > S > Cl > Ar

D) Cl > S > Al > Si > Ar

E) S > Si > Cl > Al > Ar

B

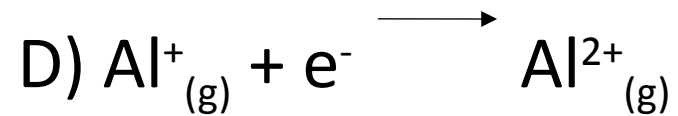It decreases on going from right to left through a period in the periodic table

7) Which equation correctly represents the first ionization of aluminum?

A) $Al^-_{(g)} \longrightarrow Al_{(g)} + e^-$

B) $Al_{(g)} \longrightarrow Al^-_{(g)} + e^-$

C) $Al_{(g)} + e^- \longrightarrow Al^-_{(g)}$

D) $Al_{(g)} \longrightarrow Al^+_{(g)} + e^-$

E) $Al^+_{(g)} + e^- \longrightarrow Al_{(g)}$
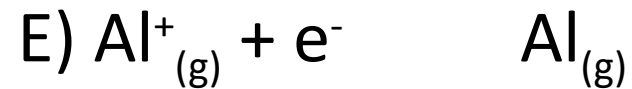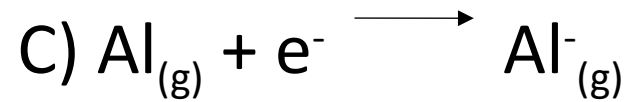
D

Energy required to remove an electron from a gaseous atom

8) Which of the following correctly represents the <u>second</u> ionization of aluminum?

A) $Al^+_{(g)} + e^- \longrightarrow Al_{(g)}$

B) $Al_{(g)} \longrightarrow Al^+_{(g)} + e^-$

C) $Al^-_{(g)} + e^- \longrightarrow Al^{2-}_{(g)}$

D) $Al^+_{(g)} + e^- \longrightarrow Al^{2+}_{(g)}$

E) $Al^+_{(g)} \longrightarrow Al^{2+}_{(g)} + e^-$
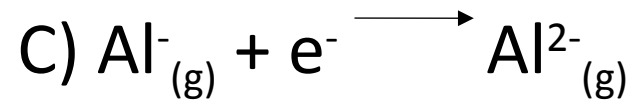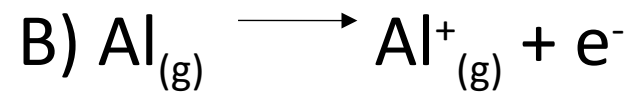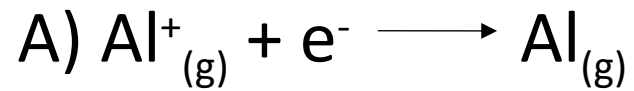
E

Energy required to remove an electron from a gaseous cation with a charge of +1

9) Of the following species, _____ has the largest radius.

A) Rb^+

B) Sr^{2+}

C) Br^-

D) Kr

E) Ar

C

Excluding Ar that has the lowest number of energy shells (3), all are isoelectronic, the one with the least protons will experience the lowest effective nuclear charge, resulting in the largest radius.

10) Chlorine is much more apt to exist as an anion than is sodium. This is because _____.

A) chlorine is bigger than sodium

B) chlorine has a greater ionization energy than

   sodium does

C) chlorine has a greater electron affinity than

   sodium does

D) chlorine is a gas and sodium is a solid

E) chlorine is more metallic than sodium

C

Atoms with higher electron affinity tend to become anions.

11) Sodium is much more apt to exist as a cation than is chlorine. This is because _____.

A) chlorine is a gas and sodium is a solid

B) chlorine has a greater electron affinity than

   sodium does

C) chlorine is bigger than sodium

D) chlorine has a greater ionization energy than

   sodium does

E) chlorine is more metallic than sodium

D

Atoms with lower ionization energy tend to become cations.

12) In the generation of most anions, the energy change (kJ/mol) that _____ an electron is _____.

D

A) removes, positive

B) adds, positive

C) removes, negative

D) adds, negative

E) None of the above is correct.

13) Which one of the following is a metalloid?

A

A) Ge

B) S

C) Br

D) Pb

E) C

14) The list that correctly indicates the order of metallic character is _____.

C

A) B > N > C

B) F > Cl > S

C) Si > P > S

D) P > S > Se

E) Na > K > Rb